

# **Hazard Elimination Project Evaluation**

Project Log # 200502101

Hazard Elimination Project W-2813

**Evaluation of the Intersection Realignment and Left Turn Lane Construction  
At the Intersection of NC 152 at SR 1210 (Goodman Road-Flat Rock Road) and SR 1211  
(Brown Road-Patterson Street), Rowan County**

Documents Prepared By:

Safety Evaluation Group  
Traffic Safety Systems Management Section  
Traffic Engineering and Safety Systems Branch  
North Carolina Department of Transportation

**Principal Investigator**

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3/1/2006  
Date

# ***Hazard Elimination Project Evaluation Documentation***

## **Subject Location**

Evaluation of Hazard Elimination Project W-2813 –  
The Intersection of NC 152 at SR 1210 (Goodman Road-Flat Rock Road) and SR 1211 (Brown Road-Patterson Street) in Rowan County

## **Introduction**

In an attempt to assess the safety of our roads, the Safety Evaluation Group of the Traffic Safety Systems Management Section has evaluated the above project. The methodologies used in this evaluation offer various philosophies and ideas, in an effort to provide objective countermeasure crash reduction results. A naïve before and after analysis has been completed to measure the effectiveness of this hazard elimination project. This information is provided to you so the benefit or lack of benefit for this type of project can be recognized and utilized for future projects.

## **Project Information and Background from the Project File Folder**

The safety countermeasures chosen for the subject location were to:

- 1) Widen NC 152 for approximately 500 feet to provide a left turn lane on both approaches of the Treatment Intersection,
- 2) Realign SR 1210 (Flat Rock Road) to intersect SR 1211 (Patterson Road) south of NC 152, and
- 3) Improve the radii on the north approach of SR 1210 (Goodman Road).

The subject location is situated in a rural residential area with South Rowan High School being located just south on SR 1211 (Patterson Street). The posted speed limits on NC 152 and SR 1211 are 55 mph and 45 mph, respectively. The south approach of SR 1210 (Flat Rock Road) has a speed limit of 55 mph and the north approach of SR 1210 (Goodman Road) has a speed limit of 35 mph. SR 1210 and SR 1211 are stop sign controlled with an overhead flashing traffic signal. NC 152, SR 1210, and SR 1211 formed a six-leg intersection prior to the improvements.

The initial crash analysis for this location was completed from January 1, 1988 through May 31, 1991 with a total of 13 reported crashes. According to the initial crash analysis, there were eight Angle crashes, two Rear End crashes, one Sideswipe Crash, and two Left Turn crashes. As stated in the Project File Folder, it was felt that all of these crashes could be attributed to motorists' confusion due to the intersection geometrics. The intersection geometric revisions and left turn lane construction were chosen to reduce confusion and alleviate these crash types. It was also noted in the Project File Folder that approximately half of the accidents at the subject location involved an inexperienced operator 18 years old or younger. Due to the close proximity of South Rowan High School, the intersection is used by a high number of inexperienced drivers. The project was completed on August 30, 1997 at a cost of \$330,000.

## Naïve Before and After Analysis

After reviewing the hazard elimination project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from May 1, 1997 through December 31, 1997. The before period consisted of reported crashes from May 1, 1990 through April 30, 1997 (7 Years) and the after period consisted of reported crashes from January 1, 1998 through December 31, 2004 (7 Years). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

In order to include the entire limits of the project, the treatment data consisted of all crashes on NC 152 within a 250 feet Y-line of the intersection with SR 1210 and SR 1211. In addition, a 150 feet Y-line was used on the approach legs of SR 1210 (Goodman Road-Flat Rock Road) and SR 1211 (Brown Road). The Y-line on SR 1211 (Patterson Street) was extended to 150 feet south of the post-treatment intersection with SR 1210 (Flat Rock Road) in order to include any crashes possibly effected by the realignment. Please see the attached *Location Map* for further detail.

The following table depicts the Naïve Before and After Analysis for the Total Crashes and Target Crashes at the treatment location. Please note that the Target Crashes for the applied countermeasure were:

- Frontal Impact crashes, which include Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle *AND*
- Rear End crashes on both approaches of NC 152.

### Treatment Information

	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Total Crashes	28	31	10.7%
Total Severity Index	14.74	7.50	-49.1%
Target Crashes	24	30	25.0%
Target Severity Index	16.10	7.72	-52.0%
Volume	7100	10100	42.3%

### Target Crash Information

	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Fatal Injury Crashes	0	0	N/A
Non-Fatal Injury Crashes	12	18	50.0%
Total Injury Crashes	12	18	50.0%
Night Crashes	4	2	-50.0%
Wet Crashes	1	5	400.0%

The naïve before and after analysis at the treatment location resulted in a 10.7 percent increase in Total Crashes, a 25.0 percent increase in Target Crashes, and a 42.3 percent increase in Average Daily Traffic (ADT). Further investigation shows there was a 49.1 percent decrease in the Severity Index for Total Crashes and a 52.0 percent decrease in the Severity Index for Target Crashes. The before period ADT year was 1993 and the after period ADT year was 2001.

## **Results and Discussion**

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 10.7 percent increase in Total Crashes and a 25.0 percent increase in Target Crashes. Further investigation shows that the Severity Index of Total Crashes and Target Crashes appear to have decreased by 49.1 percent and 52.0 percent, respectively. The summary results above demonstrate that the Treatment Location appears to have had an increase in the number of Total and Target Crashes and a decrease in the Severity Index from the before to the after period using naïve methodologies.

A breakdown of the Target crashes in the before and after period revealed the following results. Rear End crashes on NC 152 were a component of the Target Crashes because of the left-turn installation countermeasure on both approaches of NC 152. In both the before and after periods, there were no Rear End crashes on NC 152 at the Treatment Location. In the before period there were two (2) crashes which involved vehicles on NC 152 running off the road to avoid a left turning vehicle stopped in the NC 152 westbound through lane.

The Target Crashes for this evaluation also included Frontal Impact Crashes. In the before period, thirteen (13) of the twenty-three (23) Frontal Impact crashes were caused by northbound vehicles on SR 1210-Flat Rock Road and SR 1211-Patterson Road choosing improper gaps. After the realignment of SR 1210-Flat Rock Road, twenty-two (22) of the thirty-one (31) Frontal Impact crashes were caused by vehicles on northbound SR 1211-Patterson Road choosing improper gaps. It appears that the realignment of SR 1210-Flat Rock Road did not reduce the number of Frontal Impact crashes in the after period. Motorists are still making poor decisions and choosing improper gaps.

In the after period seventeen (17) Frontal Impact crashes exclusively involved northbound vehicles on SR 1211-Patterson Road and westbound vehicles on NC 152, with the SR 1211-Patterson Road vehicles being at fault. Please see the dashed circle in the after period *Collision Diagram*. Sight distance does not appear to be an issue in this crash pattern. As previously stated, South Rowan High School is located just south of the intersection on SR 1211-Patterson Road. A look at driver age reveals that 43 percent (12 of 28) of the “at fault drivers” in the before period were under the age of 25 years old. An additional 52 percent (16 of 31) of the “at fault drivers” in the after period were under the age of 25 years old. The crash pattern at this location may be an issue of driver ability/ experience.

Please see the attached Treatment Site Photos. Photos are provided for all approaches of the Treatment Intersection. The photos provided reflect the left-turn lane installations and the intersection realignment. Several photos are also provided which show the old alignment of SR 1210 (Flat Rock Road).

As the Safety Evaluation Group completes additional reviews for this type of countermeasure, we will be able to provide more objective and definite information regarding actual crash reduction factors.

**Treatment Site:**  
**NC 152 at SR 1211 and SR 1210**

The map displays a network of roads including Lake Wright Rd., Chippewa Tr., Shaene Trail, Kiowa Ct., Brown Rd., Goodman Rd., Flat Rock Rd., Patterson St., South Rowan High School, Kinball Rd., Sutton Rd., Kimball Loop Rd., Stirewalt Rd., Bamhardt Rd., Pleasant View Ln., and Teeter. Numerous numbered points are marked, such as 1660, 1638, 1604, 1659, 1668, 1211, 1210, 1209, 1436, 1437, 1438, 152, 1541, 1542, 1543, 1545, 1419, 1225, 1477, 1478, 1211, 1212, 1219, 1218, and 1211. A north arrow is located in the upper left, and a small inset map is in the bottom left corner.

*Treatment Site Photos (Taken on November 14, 2005)*



Looking west on NC 152 at the Treatment Intersection.



Looking east on NC 152 at the Treatment Intersection.



*Treatment Site Photos (Taken on November 14, 2005)*



Looking east at the Treatment Intersection from the Old SR 1210 (Flat Rock Road) alignment.



Looking south on SR 1211 (Brown Road) at the Treatment Intersection.  
Notice the dually erected Stop Signs.



*Treatment Site Photos (Taken on November 14, 2005)*



Looking south on SR 1210 (Goodman Road) at the Treatment Intersection.  
The Old SR 1210 (Flat Rock Road) alignment is shown above left.



Photo taken near South Rowan High School, looking north on SR 1211 (Patterson Road) towards the Treatment Intersection. Notice the Curve Warning Sign and Stop Sign Ahead Warning Sign.

*Treatment Site Photos (Taken on November 14, 2005)*



Looking north on SR 1211 (Patterson Road) towards the Treatment Intersection.



Looking north on SR 1211 (Patterson Road) at the Treatment Intersection.



*Treatment Site Photos (Taken on November 14, 2005)*



Driving east on SR 1210 (Flat Rock Road), looking northeast at the old alignment and the Treatment Intersection.



Looking east on SR 1210 (Flat Rock Road) at the intersection with SR 1211 (Patterson Road).



NC 152  
55 MPH

Avoiding Left Turning Vehicle  
Stopped in NC 152 WB Lane

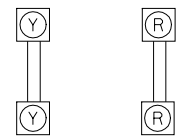
SR 1210-Goodman  
35 MPH



SR 1211-Brown  
45 MPH



SIGNAL FACE I.D.



TREATMENT SITE-TOTAL CRASHES-BEFORE PERIOD  
(MAY 1, 1990 THROUGH APRIL 30, 1997 - 7 YEARS)

### LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		P PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		B BICYCLE
	PARKED VEHICLE		BACKING		20 MPH TO 29		T TRAIN
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		A ANIMAL
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		VEHICLE FIRE
	HEAD ON		INJURY		50 MPH TO 59		* DRIVER AT FAULT
	REAR END		FATALITY		60 MPH TO 69		D DRY
	RAN OFF ROAD				70 AND UP		W WET
					SPEED UNKNOWN		DAYLIGHT CRASH
					DARK CRASH		I ICY OR SNOWY

To South Rowan  
High School



SR 1211-Patterson  
45 MPH

SR 1210-Flat Rock  
55 MPH

Avoiding Left Turning Vehicle  
Stopped in NC 152 WB Lane

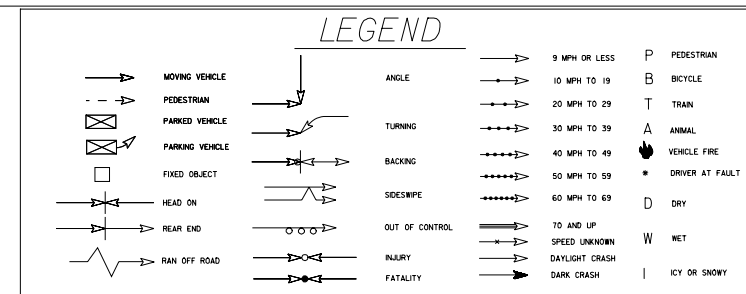
NC 152  
55 MPH

### TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

 <b>HIGHWAY SAFETY PLANNING AND MANAGEMENT</b>	<b>COLLISION DIAGRAM</b>	
	DIVISION: 9	AREA: 1
	STUDY PERIOD: 5/1/1990-4/30/1997	
	DISTANCE: Y-LINE = 150 FT	
	ANALYSIS PREPARED BY: C. SIMPSON	
 <b>HIGHWAY SAFETY MANAGEMENT</b>	ANALYSIS CHECKED BY:	
	DIAGRAM PREPARED BY: C. SIMPSON	
	DIAGRAM REVIEWED BY:	
	SCALE:	NOT TO SCALE
	DATE:	10/24/05
LOG NUMBER: 20050201		

W 2813  
BEFORE PERIOD

**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRAFFIC ENGINEERING AND SAFETY**  
**SYSTEMS BRANCH**



TREATMENT SITE-TOTAL CRASHES-AFTER PERIOD  
(JANUARY 1, 1998 THROUGH DECEMBER 31, 2004 - 7 YEARS)

SR 1210-Goodman  
35 MPH

NC 152  
55 MPH

45 MPH  
SR 1211-Patterson

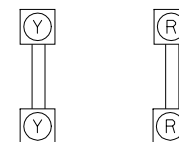
To South Rowan  
High School

SR 1210-Flat Rock  
55 MPH

SR 1211-Brown  
45 MPH

NC 152  
55 MPH

**SIGNAL FACE I.D.**



**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

<b>COLLISION DIAGRAM</b>	
DIVISION: 9	AREA: 1
STUDY PERIOD: 1/1/1998 - 12/31/2004	
DISTANCE: Y-LINE = 150 FT	
ANALYSIS PREPARED BY: C SIMPSON	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: C SIMPSON	
DIAGRAM REVIEWED BY:	
SCALE: NOT TO SCALE	
DATE: 10/24/05	
LOG NUMBER: 20050201	

**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRAFFIC ENGINEERING AND SAFETY**  
**SYSTEMS BRANCH**